AN EOCENE SEA-PEN FROM DUNEDIN, NEW ZEALAND

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ABSTRACT. A new Upper Eocene pennatulid from the Burnside Mudstone, Dunedin, New Zealand, is described and named *Bensonularia spatulata*. It is assigned to the Family Veretillidae.

THIS is the first record of a pennatulid to be collected from Tertiary marine strata in New Zealand. The specimen was collected by the writer from a calcareous mudstone, the Burnside Mudstone, in the quarry operated by the Milburn Lime and Cement Co., Ltd., Burnside, Dunedin. Specimens of fossil pennatulids are relatively rare owing mainly to their delicate structure and the hazards of preservation. The Burnside specimen, however, consists of an almost complete rachis and is remarkably well preserved (Pl. 42, fig. 3). Bayer (1956, p. F224 et seq.) includes eleven families in the Suborder Sessiliflorae of the Pennatulacea, and the only fossil representatives of this suborder previously recognized are placed in the Family Renillidae. These forms show bilateral symmetry. The Burnside specimen lacks bilateral symmetry, so that it represents the most primitive evolutionary stage yet found in the fossil record.

Phylum COELENTERATA
Class ANTHOZOA
Subclass OCTOCORALLIA
Order PENNATULACEA Verrill 1865
Suborder SESSILIFLORAE Kükenthal 1915
Family VERETILLIDAE Herklots 1858
Genus BENSONULARIA gen. nov.

Type species *Bensonularia spatulata* gen. et sp. nov.

Diagnosis. Well-developed colony, compressed, but without bilateral symmetry, bearing zooids regularly arranged in sinistral and dextral spirals over the surface of the rachis. No calices. Spicules of the rachis are spindle-shaped.

Discussion. The compressed spatulate rachis of the specimen suggests an incipient bilateral symmetry, but the symmetry of the colony is dominantly radial as in the primitive Family Veretillidae. The zooids are arranged in a double spiral over the rachis, and this represents a considerable advance in symmetry over the irregular distribution of the zooids on the rachis so commonly found in the Family Veretillidae. This double spiral arrangement, however, is more primitive than the transverse rows of zooids characteristic of the Family Echinoptilidae. In that family incipient bilateral symmetry is shown by the trace of a groove or track on the rachis, and this groove is free of autozooids (Hickson 1918, p. 118). There is no trace of a groove on the surface of *Bensonularia*.

The spicules of the rachis of *Bensonularia* are constant both in form (i.e. spindles) and size (about 1 cm. long), as far as can be determined from the specimen. This constancy of spicule form contrasts with most of the sea-pens placed in the Family Vere-

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tillidae. The primitive Veretillids show great variability in spicule shape and size, even between specimens of the same species collected from a similar locality (Hickson 1918, p. 126). The same author points out (1918, p. 123) that the spicules in the more advanced bilaterally symmetrical pennatulids 'are constantly of the same form and approximately of the same size'.

Though the arrangement of the zooids and the regular spicule form are comparatively advanced characters, these features are associated with radial symmetry only, so that *Bensonularia* is placed in the Family Veretillidae.

If *Bensonularia* is truly an advanced Veretillid, then the occurrence of an axis becomes at least probable. Hickson (1918, p. 119) points out that the occurrence of an axis in forms assigned to the Family Veretillidae is very variable, but in the higher forms, with stronger muscles to meet the needs of a free colony, the axis becomes a more constant feature. As the colony of *Bensonularia spatula* is large and in some respects advanced, it seems probable that an axis, possibly incomplete, was present in the living form.

The genus is named after the late Professor-Emeritus W. N. Benson, as a tribute to his contribution to the palaeontology and stratigraphy of the Dunedin district.

Bensonularia spatulata sp. nov.

Plate 42, figs. 3, 4

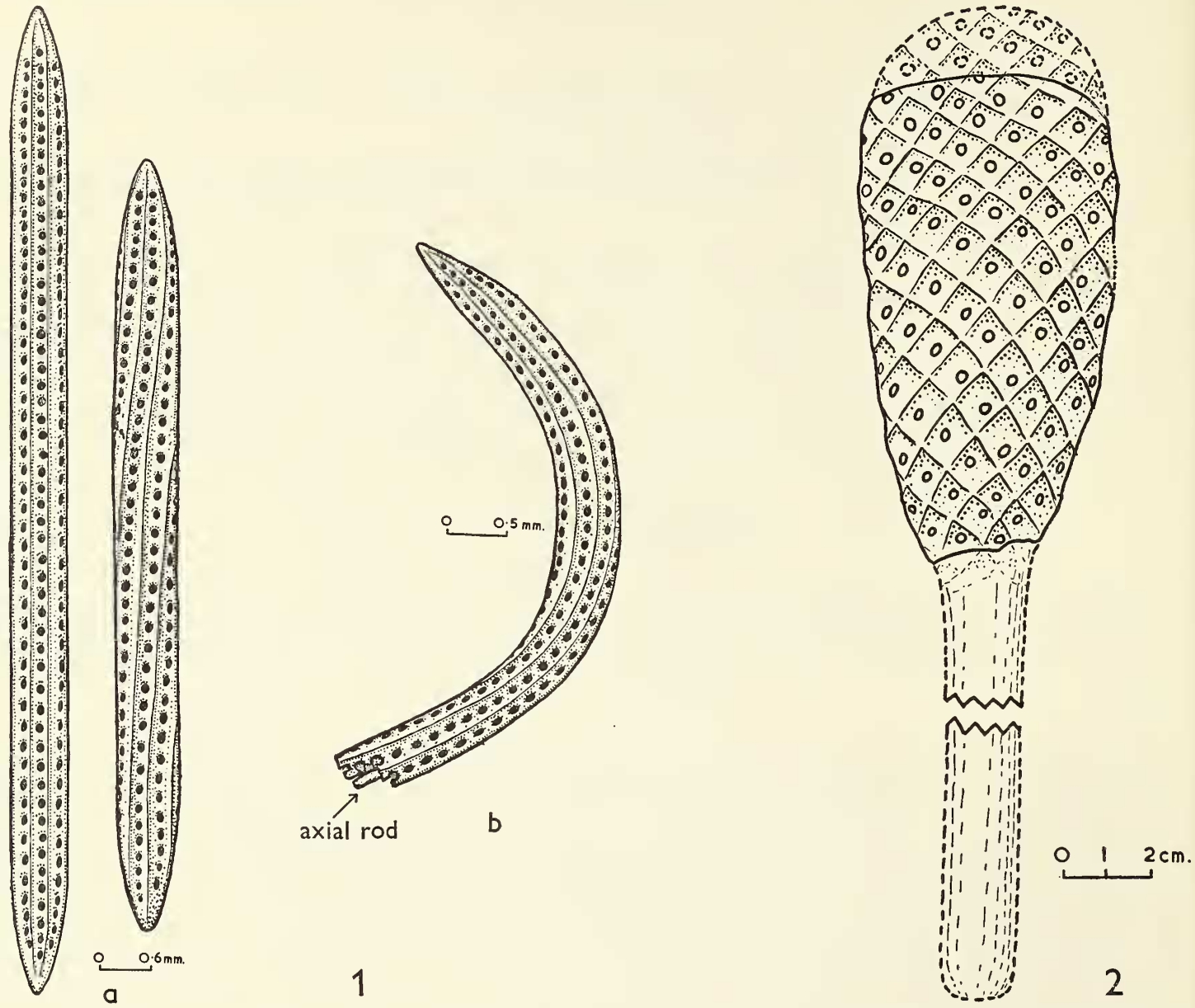
Holotype. O.U. 5846. Specimen from Burnside Mudstone, Bortonian Stage (Upper Eocene), Burnside, Dunedin, New Zealand. In the Geology Department, University of Otago.

Diagnosis. Well-developed colony, compressed and spatulate in form. Zooids arranged in ascending sinistral and dextral spirals over the whole surface of the rachis. Zooid spirals separated by low ridges, which, on crossing, form diamond-shaped areas on the rachis. A single zooid occurs in each diamond-shaped area. Spicules are spindle-shaped, thickly pointed at each end, with six low hyaline ridges running the full length of the spicule, often in a slightly dextral spiral (text-fig. 1*a*). Between these hyaline ridges are single longitudinal rows of deep pits, which penetrate to a central axial rod in the spicule. Spicules of the coenenchyme lie parallel to the outer surface, interwoven, but with the longer spicules arranged longitudinally (Pl. 42, fig. 4).

Description. The specimen is preserved in a homogeneous, light-grey, calcareous mudstone matrix, and the filling of the gastric cavity is of the same lithology. The specimen (Pl. 42, fig. 3) consists of the major portion of the rachis and the mould of one side. The rachis is compressed. As other delicate fossils in the Burnside Mudstone show only slight or no distortion, it is probable that the preserved shape is that of the living colony. This interpretation is supported by the fact that the spicular arrangement on the specimen shows only slight signs of distortion along the flattened margins.

The precise nature of the spicules is rather difficult to determine, for, like some other calcareous remains in the Burnside Mudstone, they have been converted almost completely to marcasite and pyrite. However, fragmentary portions show an outer hyaline calcite layer with the six hyaline longitudinal ribs and also the pointed ends of the spicules. The fine mudstone matrix faithfully preserves the moulds, which clearly show the single row of pits between the ribs. Reconstructions of two rachis spicules are shown

in text-fig. 1*a*. The structure is best shown by a partly altered C-shaped spicule taken from the supporting bundle around a zooid pore (text-fig. 1*b*). The broken end of the spicule reveals the pits penetrating to the central axial rod.



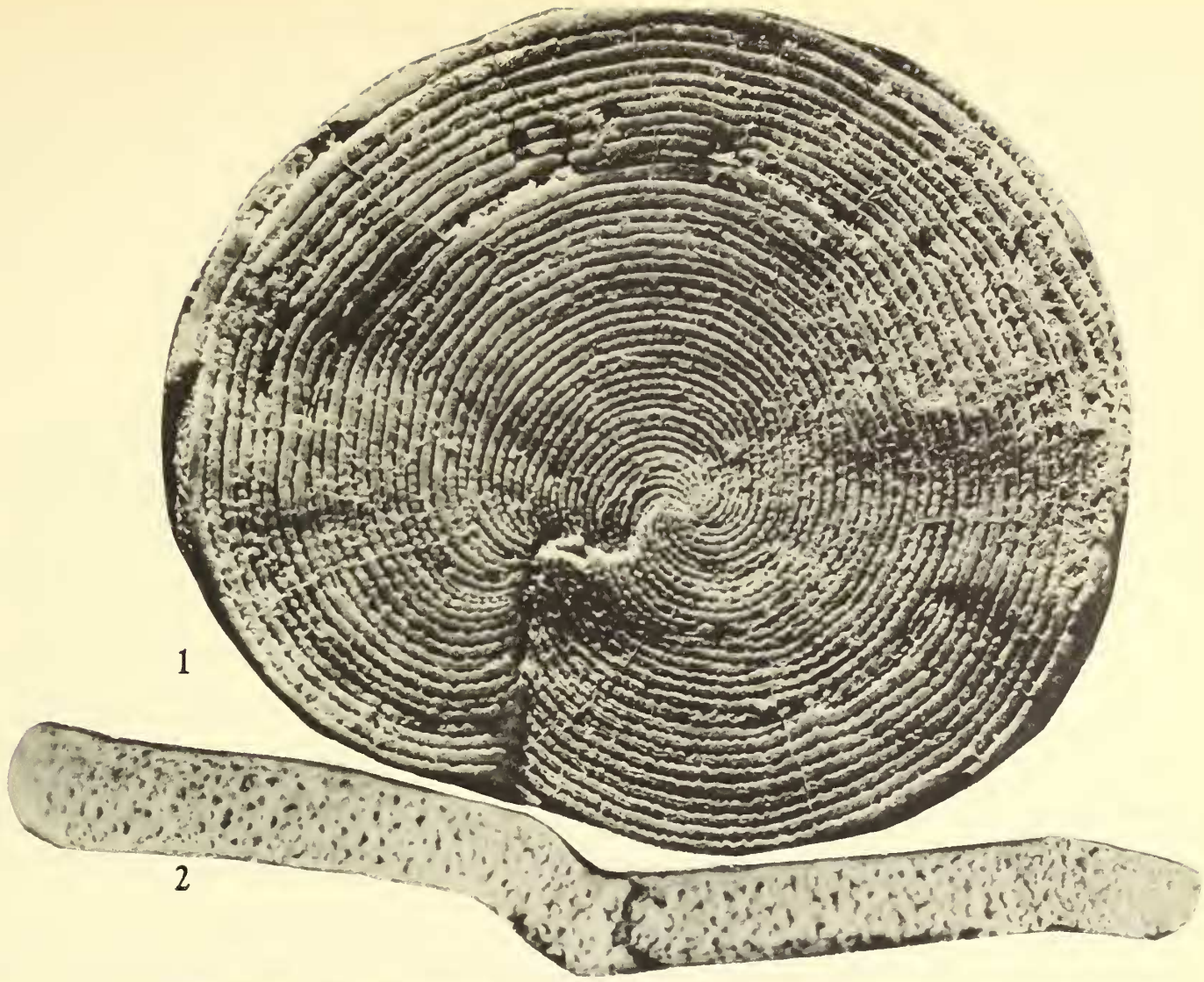
TEXT-FIGS. 1, 2. *Bensonularia spatulata* gen. et sp. nov. 1*a*, Spicules of the rachis. 1*b*, Scaphoid spicule from supporting bundle; broken end shows central axial rod. 2, Reconstruction.

Though Recent pennatulids invariably have dimorphic zooids, the pores on *Bensonularia spatulata* are all about 3 mm. in diameter. It is therefore not possible to distinguish between the distribution of the autozooids and siphonozooids on the rachis. The ridges separating the zooid spirals are low, and on the specimen the dextral spiral ridges are only weakly developed.

EXPLANATION OF PLATE 42

Figs. 1 and 2. *Archaias floridanus* (Conrad), Lower Miocene Tampa Formation, Tampa Island, Cherokee Sink, Wakulla County, Florida, U.S.A.; U.S.G.S. specimen f. 3838. 1, Shows the decorticated lateral surface; × 10. 2, The margin with the radial wave; × 15.

Figs. 3 and 4. *Bensonularia spatula* gen. et sp. nov., Eocene, Dunedin, New Zealand. 3, Shows the double spiral arrangement of the zooids and ridges on the rachis. 4, The spicular arrangement; note the longitudinal alignment of the long spicules.



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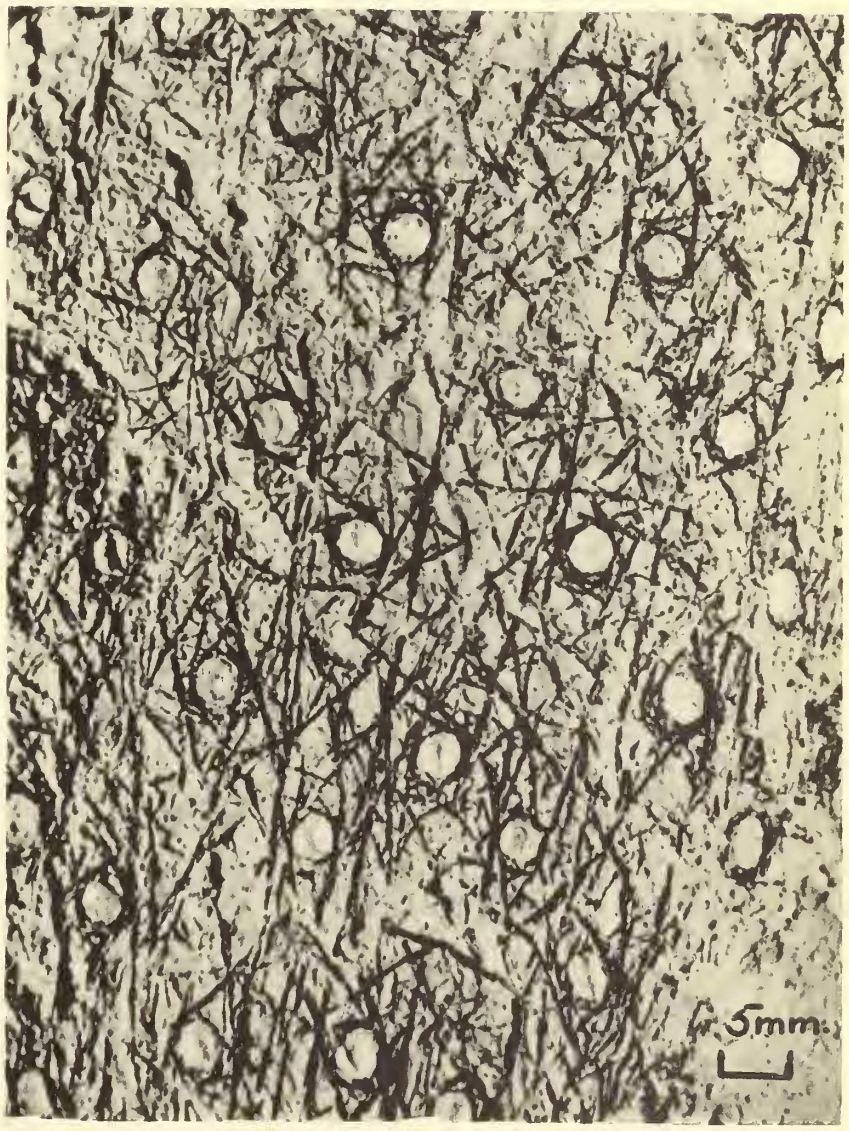

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SMOUT AND EAMES, *Archaias*
HAMILTON, Sea-Pen from New Zealand